Appendix F

Firefinder Mask Considerations

This appendix explains how to calculate the track volume for the Firefinder radars. It is intended for use by the radar section leader to enable him to determine whether a radar site will provide enough track volume to locate hostile firing positions. It also provides procedures for correcting insufficient track volume.

DEFINITIONS

The following definitions are associated with mask:

- Flat mask is a single mask angle or a default value in the radar when no mask angle is entered into the radar computer. The flat mask default for the AN/TPQ-36 radar is 20 mils. The flat mask for the AN/TPQ-37 radar is 8 mils.
- Mask angle is the vertical angle from the radar to the top of the mask, or screening crest, at a given azimuth. The lowest mask angle and the highest mask angle are calculated and entered in the radar's computer during initialization.
- Mask variation is the difference between the lowest and highest mask angles.
- Vertical scan is the maximum vertical scanning capability of a specific type of radar. Vertical scan for the AN/TPQ-36 radar is approximately 80 mils with all scanning frequencies enabled. Each frequency that is disabled results in a loss of approximately 2.5 mils of vertical scan. Vertical scan for the AN/TPQ-37 radar is approximately 104 mils. Since this radar uses phase or phase scan rather than the phase or frequency scan used by the Q-36, no vertical scan is lost when some of the frequencies of the Q-37 are disabled.

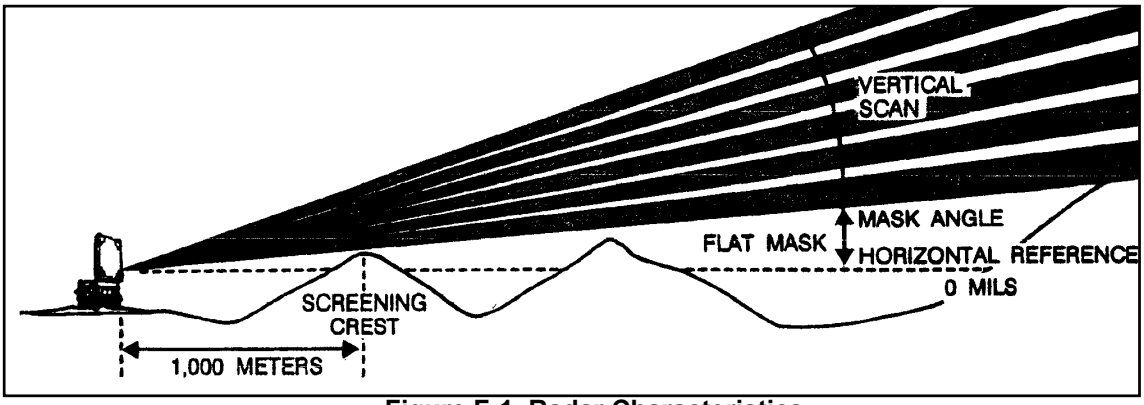

Figure F-1. Radar Characteristics

TRACK VOLUME

The amount of track volume is determined by the vertical scan of the radar and the amount of vertical scan that is lost because of the terrain contour, or screening crest, in front of the radar. From any radar position, the altitude of the screening crest along the terrain contour in front of the position will vary across the radar's sector of search. This varying screening crest altitude results in varying mask angles along the terrain contour. The variance between the smallest mask angle and the largest mask angle reduces the radar's vertical scan.

Sometimes this reduction is enough that the available scan coverage is less than the 50-mil track volume required by the radar to extrapolate weapon locations. When the track volume is reduced below 50 mils, the radar section leader must compensate by artificially adjusting the low mask angle, narrowing the search sector, or by moving the radar to a new position that provides adequate track volume.

Whenever possible, an aiming circle or other accurate measuring device should be used to determine mask angles along the terrain contour. These measured mask angles are entered in the computer to depict the terrain contour. Otherwise, the radar will radiate into hill masses that are higher than the flat mask default in the radar computer. The Q-36 has the ability to conduct automatic terrain following to determine mask angles. Automatic terrain following can be used when digital terrain is available for the location of the radar site. This capability allows the radar section leader to compute mask angles before occupying a radar site. Automatic terrain following is not as accurate as taking manual measurements from the radar site. Therefore, manual mask measurements should be taken as soon as practical after occupying a new radar site.

TRACK VOLUME CALCULATION AND SUBSEQUENT ACTIONS

The Firefinder search fence starts at the lowest mask angle entered in the radar computer (or at the flat mask default value if no lowest mask angle is entered) and goes to the highest point of the vertical scan. The first step in calculating track volume for the radar site and search sector is to subtract the low mask angle from the high mask angle. This difference must then be subtracted from the vertical scan of the radar. The result is the track volume for the radar site. Figure F-2 shows the procedure for calculating track volume.

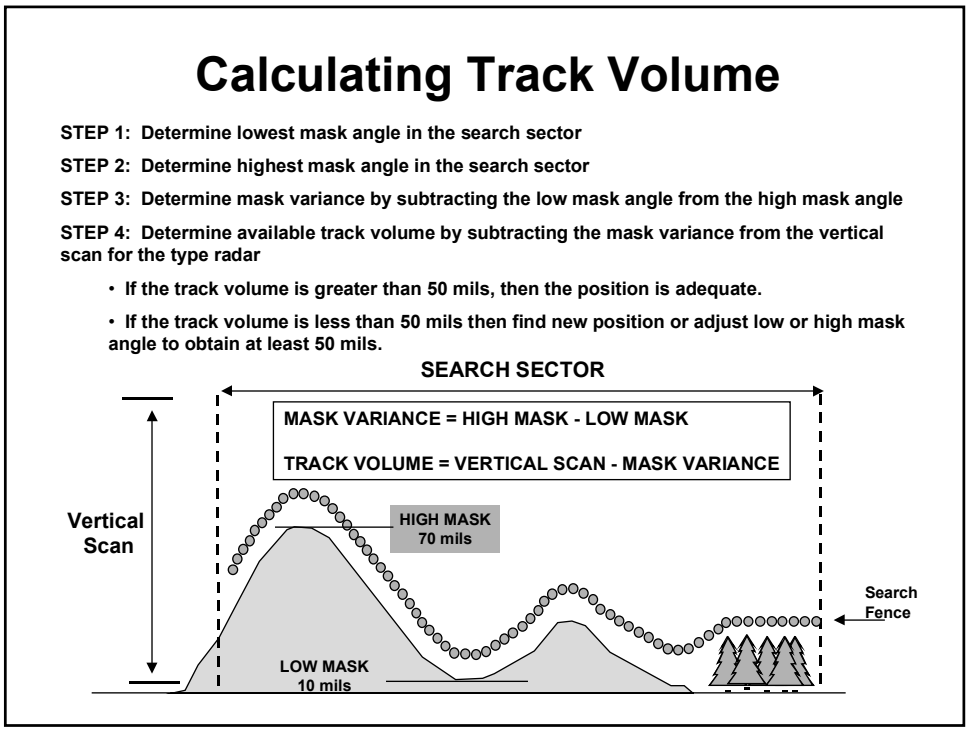

Figure F-2. Track Volume

Although the ideal mask variation may be met, the maximum allowable mask variation for a radar can be calculated by subtracting the 50 mils of track volume required for firing weapon location from the vertical scan of the radar. The maximum allowable mask variations are:

- Q-36 – 30 mils.
- Q-37 – 54 mils.

Thus, any mask variation exceeding the allowable maximum variation would not allow enough track volume for the radar to determine firing weapon locations. In that event, some action must be taken to regain enough track volume to perform the radar mission. Possible actions include doing nothing, raising the low mask angle, narrowing the search sector, or moving the radar. If nothing is done a dead space is created where projectiles cannot be detected. Figure F-3 depicts a dead space area.

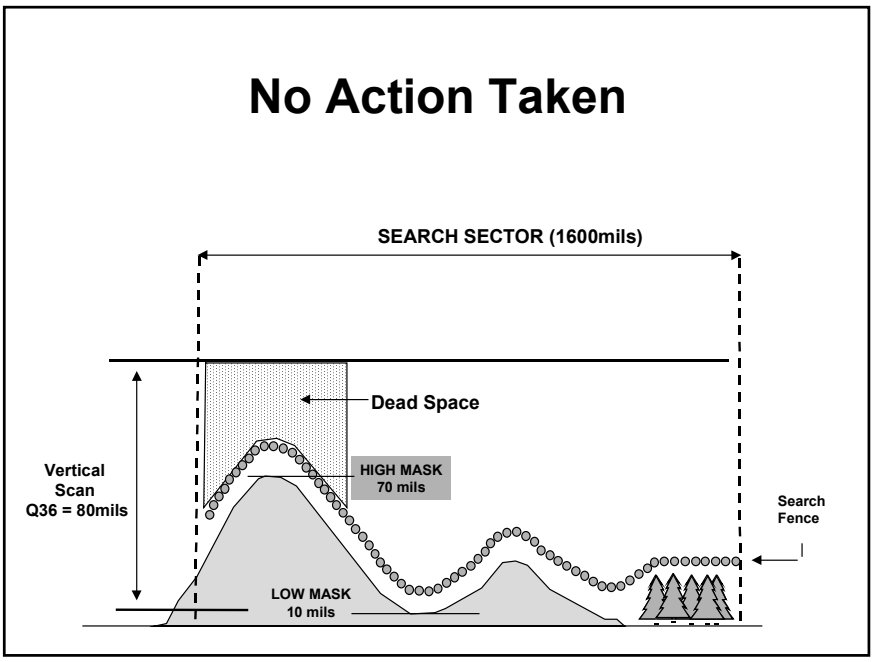

Figure F-3. Dead Space Area

In the example in Figure F-3, the mask variation is 60 mils, which only allows 20 mils of track volume over portions of the search sector. This creates a dead space area. The result is an area where hostile weapons cannot be detected. Figure F-4 shows the possible adverse effects of a dead space area.

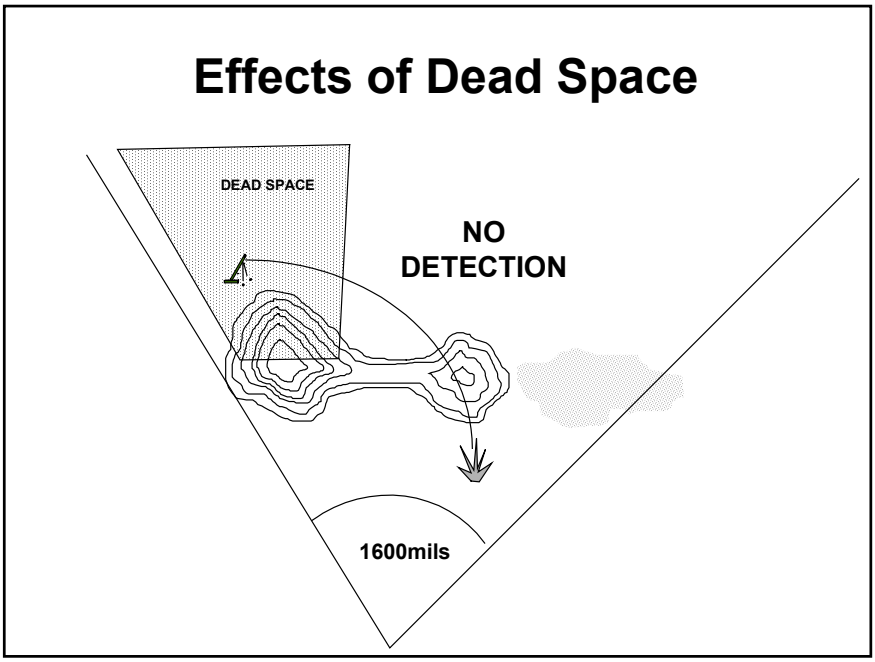

Figure F-4. Effects of a Dead Space Area

The first solution is to raise the low mask angle. This will provide enough track volume to eliminate the large dead space area. Nonetheless, this solution will produce a small dead space area under the low mask area. This may or may not be acceptable. Figure F-5 shows the result of raising the low mask angle.

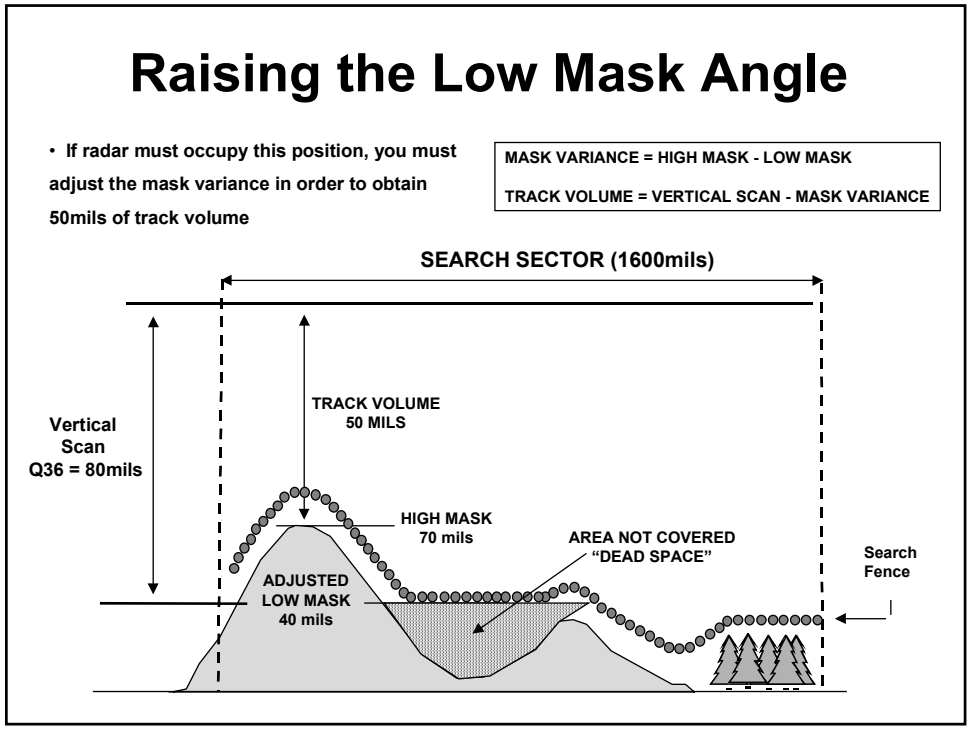

Figure F-5. Raising the Low Mask Angle

The next solution might be to narrow the search sector or move the search sector. This will lower the mask variation and eliminate the dead space in the search sector. This still leaves an area with no radar coverage. Narrowing the search may not be acceptable based on the tactical situation. Figure F-6 depicts narrowing the search sector.

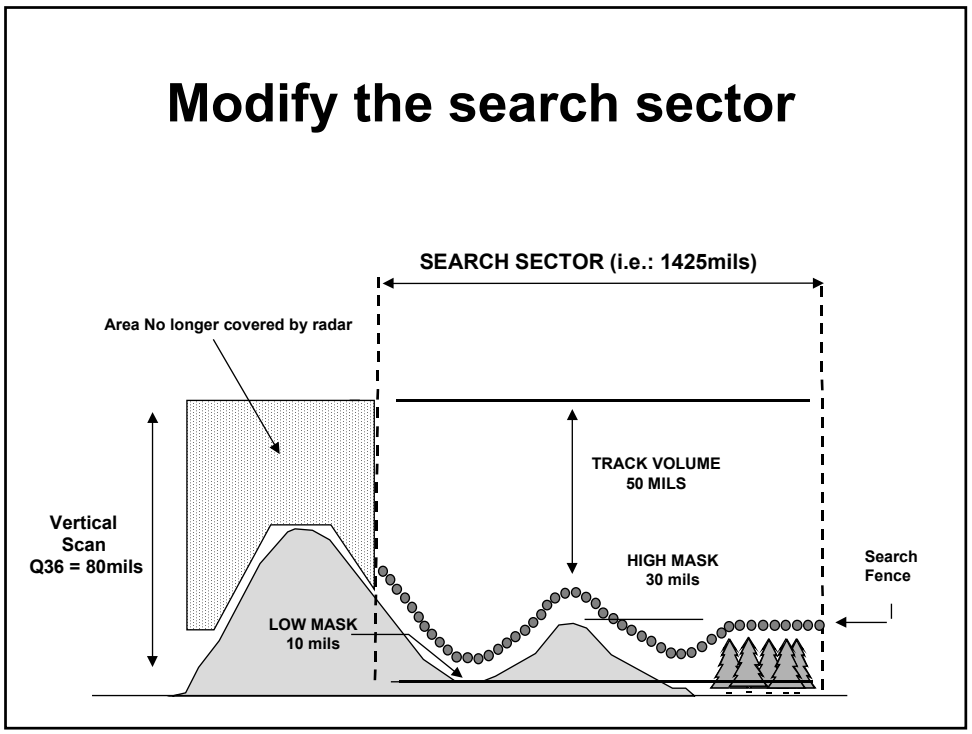

Figure F-6. Modifying the Search Sector

If none of these solutions are acceptable, the radar must be moved to another site to provide the required coverage. The radar section leader must recompute mask angles and track volume at the new location.